

**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND
TECHNOLOGY
KISII LEARNING CENTRE
FIRST YEAR SEMESTER ONE EXAMINATION FOR THE DIPLOMA/CERTIFICATE
IN COMMUNITY HEALTH AND DEVELOPMENT.**

**SMA 2111 - MATHEMATICS I TIME – 2 HOURS
INSTRUCTION: Answer question one (compulsory) and any other two questions
QUESTION ONE (30 MARKS)**

- a) Define the following terms as used in elementary set theory:
- i) Singleton set (1mk)
 - ii) Sets of sets (1mk)
 - iii) Cardinality of a set (1mk)
- b) Let $Y = \{a, x, p, r, d, g, t, k\}$, $H = \{0, -1, +7, \}$. Find
- i) $|Y|$ (1mk)
 - ii) $|H|$ (1mk)
 - iii) Is Y and H comparable? Give a reason for your answer.(2mks)
- c) i) Define a power set (1mk)
- ii) Consider set $A = \{a, b, c\}$. Find $P(A)$ (2mks)
 - iii) Let A, B and C be subsets of the universal set U. Prove that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ (3mks)
 - iv) If 65% of Kenyans like Fanta while 75% like Coke. Determine the percentage of Kenyans who like both Fanta and Coke if Kenyans are approximately 40 million. (4mks)
- d) In a triangle, $\cos \theta = 15/17$ and $\tan \theta < 0^\circ$. Find $\sin \theta$ without using tables or calculators. Appropriate diagram necessary. (4mks)
- e) i) Use the method of completing square to solve the value of x if $(x+1)(x+3)=13$ (3mks)
- ii) Calculate the smallest number of terms of the G.P, $8+24+72+\dots$, which will give a total greater than 1 million (3mks)
- f) In a triangle, $c=12\text{cm}$, $a= 10\text{cm}$ and $\angle A = 30^\circ$. Calculate the radius of the circumcircle of the triangle and the remaining angles of the triangle (3mks)

QUESTION TWO (20MARKS)

- a) i) solve $4\sec t = 5$ for the range $0^\circ \leq t \leq 360^\circ$ (3mks)
- ii) Show that $\sin^2 t \cot t \sec t = \sin t$ (3mks)

- b) i) Define the term a mapping as used in set theory given two sets A and B and that $x \in A$, $y \in B$. (2mks)
- ii) Let $f(x) = 2x + 1$ and $g(x) = x^2 + 2$. Find the values of $f \circ g(3)$ and $g \circ f(3)$. (4mks)
- c) Let Q be the set of rational numbers. Let the function $f: Q \rightarrow Q$ defined by $f(x) = 2x + 7$. Find
- i) $f^{-1}(x)$ (3mks)
- ii) $f^{-1}(1)$ (2mks)
- d) Let $f: Q \rightarrow Q$ be defined by $f(x) = 4x + 3$, $x \in Q$. Show that f is 1-1 function (3mks)

QUESTION THREE (20MARKS)

- a) Given two sets, $A = \{a, b, c, k, p, q, r, s\}$ and $B = \{b, k, q, m, n, o, t\}$, find
- i) $A - B$ (1mk)
- ii) $B - A$ (1mk)
- iii) $A \oplus B$ (2mks)
- iv) With the help of Venn diagram, illustrate $A \oplus B$, indicating clearly the elements in the respective sets. (3mks)
- v) Prove that $\sqrt{2}$ is not rational (5mks)
- b) Given that $\sqrt{37} = 6.0838$ and $\sqrt{35} = 5.9161$. Evaluate without using tables or calculators

$$\frac{1}{(\sqrt{37} - \sqrt{35})} \quad (4mks)$$

- c) Solve the simultaneous equations

$$\begin{aligned} xy &= 160 \\ \log x - 3\log y &= 1, \text{ for } x > 0, y > 0 \end{aligned} \quad (4mks)$$

QUESTION FOUR (20 MARKS)

- a) Define the following terms
- i) A sequence of terms (1mk)
- ii) An Arithmetic Progression (2mks)
- b) In an A.P, the 4th term is 13 and the 7th term is 22. Determine
- i) The first term and common difference (3mks)
- ii) The value of n if the nth term is 100 (4mks)
- iii) The value of m if the sum to m terms of the series is 175 (4mks)
- c) A supplier in a company makes a single deposit of ksh.32, 000 in an account which pays compound interest at a rate of 4% P.a.

- i) How much is the investment worth after 12years (3mks)
- ii) After how many years will the investment be worth 3 times its initial value? (3mks)

QUESTION FIVE (20MARKS)

- a) Differentiate between combination and permutation of the elements of a set (2mks)
- b) A museum has 7 paintings to hang and 3 vacant locations, each of which will hold one painting. In how many different ways can these 3 locations be filled by the paintings? (2mks)
- c) Fifteen people entered a talent contest. The top 3 contestants will each win Ksh.1million and everyone else will get an honorable mention.
 - i) In how many different ways can 3 winners be chosen? (2mks)
 - ii) In how many different ways can 12 people be chosen for honorable mention? (2mks)
- d) i) Give an expression for the r^{th} term in a binomial theorem for the expansion of any binomial $(a+b)^n$, where n is a positive integer. (2mks)
- ii) Approximate the value of $(1.015)^{20}$ by using the first two terms of a binomial expansion (2mks)

e) The data below represents the number of points scored by different table tennis players in a tournament.

Points	20-29	30-39	40-49	50-59	60-69	70-79	80-89
Players	2	3	9	14	17	4	1

Using an appropriate assumed mean, estimate

- i) The mean (4mks)
- ii) The median(2mks)
- iii) The standard deviation (2mks)